Entanglement Dynamics in Vacuum Pair Production Under Multi-Pulse Laser Fields

D Sah[1]

[1] *Theory and Simulations Lab, Raja Ramanna Centre for Advanced Technology, Indore, INDORE, India*
Contact Email: dsah129@gmail.com

Based on the non-perturbative kinetic theory of electron-positron pair production in vacuum under the influence of time-dependent electromagnetic fields, we investigate the evolution of quantum entanglement as characterized by logarithmic negativity [1]. Within the framework of spinor quantum electrodynamics, we analyze various configurations of multi-train laser pulse fields and their impact on entanglement dynamics. The variation in logarithmic negativity arises due to the external field's influence and the distinction between the in- and out-states of the quantum system—features that are indicative of field-induced phase transitions [2,3]. Our results highlight the entanglement structure emerging in vacuum fluctuations driven by intense, structured laser fields.

References

[1] Y Li, Y Dai and Y Shi, Phys. Rev. D **95**, 036006 (2017)

[2] C Banerjee and M P Singh, Phys. Rev. D **100**, 056016 (2019)

[3] S A Smolyansky, A D Panferov, D B Blaschke, L Juchnowski, BKampfer and A Otto, Russ. Phys. J. **59**, 1731 (2017)

[4] G V Dunne, A Florio and D E Kharzeev, Phys. Rev. D **108**, L031901 (2023)